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# BUSH LIMA BEANS AS A MARKET GARDEN CROP

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## SUMMARY

Since green lima beans, as ordinarily handled, are a very perishable commodity, there would be less risk in handling the crop if it were grown close to market.

The bush types of lima beans are better adapted to production under market-garden conditions in the corn belt than the pole types. Only the large-seeded types of limas are popular on the market. These are less reliable croppers than the small-seeded type. These experiments were therefore conducted with a view to developing a method of securing better yields from the large-seeded types.

Overhead irrigation increased the average yield of beans 44 percent. In market gardens equipped for irrigation it is therefore recommended that lima beans be planted where they can be irrigated. The highest average yields were secured where the conditions for vegetative growth were made most favorable by irrigation and applications of nitrate of soda.

When grown without irrigation, inoculation of the lima bean seed with the same kind of bacteria that are used to inoculate cowpeas increased the average yield 19 percent. Yields in the irrigated beans, however, were not materially improved by inoculation.

Fertilization with steamed bone increased the yields as compared with no treatment, but did not result in quite such high average yields as inoculation when both lots were grown without irrigation.

There were greater differences in average yields between different varieties than between different treatments. The Dreer's Bush Lima produced by far the highest yields.

Most markets now demand that lima beans be shelled before they are offered for sale. In local markets where the producer comes directly in contact with the consumer it might be possible to educate the public to purchase lima beans in the pod, and thus secure the advantage of less perishability, better sanitary conditions, and a lower-priced product.

# BUSH LIMA BEANS AS A MARKET GARDEN CROP

By J. W. Lloyd, Chief in Olericulture

Green lima beans are recognized as a table delicacy and command a high price. They are grown principally in a few special localities, and shipped considerable distances to the large markets. Shipments are not usually made directly from producing points to the smaller cities.

Most markets demand that green lima beans be shelled before they are offered for sale. This means, in most cases, shelling before shipment and, therefore, transportation of the freshly shelled beans. Green shelled beans are a precarious commodity to ship, especially in warm weather, and often reach the market in a discolored or even moldy condition; and in such condition they are of little value. Reshipment to smaller markets increases the hazard, and this is one reason why the smaller markets do not handle them.

There would be certain advantages in growing lima beans as a market-garden crop close to local markets not now adequately supplied. There would be much less risk of losing the crop after it was produced, than in distant shipments. On the other hand, certain disadvantages would be encountered if the same type of beans were grown and the same cultural methods employed as are common in the trucking centers now growing green limas. The markets demand the large-seeded types. The pole or running varieties chiefly are grown in the trucking regions. These regions are located for the most part where native timber is abundant, and saplings can readily be secured for poles. In the vicinity of many local markets in the corn belt, there is no timber land from which poles may be cut, and available substitutes for bean poles are very expensive if purchased at a lumber yard.

Because of the foregoing facts attention is directed toward the bush forms of lima beans, which require no poles or other supports. Of these the Sieva, or small-seeded type, is easily grown and is an abundant cropper. The market, however, is prejudiced against small-seeded limas, and the shelling of them is a tedious task. The bush forms of the large-seeded limas would be admirably adapted to growing under market-garden conditions in the corn belt except for one drawback. Attempts to grow them have usually resulted in disappointment because they have produced such meager yields. It is a common occurrence for the plants to make a robust growth and blossom freely, but fail to set or develop many pods.

With a view to determining the cause of low yields in bush limas, and developing a method of culture that would result in larger yields, certain experiments were started at the Illinois Agricultural Experiment Station, at Urbana, in 1919, and were continued thru five years. These experiments included: (1) the growing of limas with overhead irrigation; (2) the inoculation of the seed; (3) increasing the nitrogen supply by means of sodium nitrate; (4) supplying an abundance of phosphorus by the use of bone meal.

In order to make the test as fair as possible, five different varieties of beans were used: Burpee Improved Bush Lima, Burpee's Bush Lima, New Wonder Bush Lima, Dreer's Bush Lima, and Fordhook Bush Lima. The last two varieties are of the potato lima type, with thick, plump seeds, while the others are of the large, flat type. Both types are classified on the market as large limas and sell equally well.

## CONDITIONS OF EXPERIMENTS

*Seed Planted Late.*—Since the large limas demand high temperature, and the seeds are likely to rot in the ground if planted when the soil is too cold and wet, in these experiments the planting of the beans was delayed until after the first of June. In most years, the seeds were planted between June 1 and 10, but one year planting was deferred until June 20.

*Layout of Rows.*—Twenty-five hills of each variety were grown under each treatment. The hills were placed 2 feet apart in the row, while the rows were 3½ feet apart. Four seeds were planted in each hill, but usually the stand did not average over 3 plants to a hill. The plantation of beans consisted of six rows, each containing all five varieties. Three rows were within range of an overhead irrigation pipe, while the other three were not. The treatments of the various rows were as follows:

1. Not irrigated, check.
2. Not irrigated, fertilized with bone meal.
3. Not irrigated, seed inoculated.
4. Irrigated, check.
5. Irrigated, fertilized with sodium nitrate.
6. Irrigated, seed inoculated.

*Treatment of Irrigated Rows.*—The rows to be irrigated were watered as often as the nature of the season made it seem advisable; whenever the soil became fairly dry, irrigation was resorted to. In three years out of the five the rainfall was quite deficient in June, and the irrigation helped materially in hastening germination. Later irrigation was sufficiently frequent to keep the plants from suffering from lack of water at any time.

*Inoculated Rows.*—Seed for the inoculated rows was inoculated with a special culture of bacteria furnished thru the courtesy of the

Department of Agronomy. The bacteria in the culture were the same as those that are effective in the inoculation of cowpeas. Immediately before planting, the seeds were dipped in water in which a small quantity of the culture had been thoroly mixed.

*Nitrate of Soda Applications.*—The beans fertilized with nitrate of soda were given two applications, at the rate of ½ ounce per hill at each application. The first application was made approximately four weeks after the seed was planted, and the second application three weeks later. The nitrate was first pounded to crush all large lumps, then the required quantity was scattered in a circle about each hill, and worked into the soil by hoeing. Care was taken to avoid letting any of the nitrate come in direct contact with the foliage, stems, or roots of the plants.

*Bone Meal Applications.*—In using the bone meal as a fertilizer for the beans in Row 2, the material was applied at the rate of 2 ounces per hill just before the seeds were planted. After the land was marked out, the required quantity of bone meal was placed where each hill was to be planted, and was very thoroly mixed with the soil by means of a hoe.

*Cultivation and Picking.*—The beans were given good cultivation thruout the season, care being taken to treat all lots alike in this respect. When the beans reached the right stage of maturity for use as green shelled beans they were picked. Successive pickings were made as necessary thruout the season, until the plants were killed by frost.

The product from each treatment in each variety was weighed separately. To avoid delay and to simplify handling, the weights were taken of the beans in the pod, rather than after shelling, and the records are therefore given on the basis of the combined weight of beans and pods. Normally the shelled beans weigh approximately half as much as the pods and beans together.

Since there was considerable variation in the stand of plants from year to year, it has seemed best for purposes of comparison to reduce the yield records to terms of average weight of product per plant. Undeveloped pods on the plants at times of frost are not included in the yield records.

## RESULTS OF TESTS

### Irrigation Increases Yields of All Varieties

The influence of irrigation upon the yield of lima beans is shown by the figures given in Table 1. These represent the yields from irrigated and non-irrigated plants that received no other treatment, such as inoculation or special fertilizing, and show the influence of irrigation alone. It will be seen that the results of irrigation were most striking

TABLE 1.—YIELDS OF LIMA BEANS WITH AND WITHOUT IRRIGATION
(Weight of pods per plant in ounces)

| Variety | Irrigated | | | | | | Not irrigated | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. |
| Burpee Improved | .28 | 6.07 | 2.80 | 5.58 | .30 | 3.00 | .40 | 3.00 | 2.33 | 6.19 | .45 | 2.47 |
| Burpee's Bush | 1.10 | 6.64 | 4.00 | 4.32 | 1.03 | 3.41 | .60 | 1.40 | 2.08 | 5.26 | .40 | 1.95 |
| New Wonder | 1.10 | 4.92 | 5.70 | 4.44 | .84 | 3.40 | 1.30 | 2.00 | 1.58 | 6.66 | .63 | 2.43 |
| Dreer's | 5.80 | 8.83 | 5.50 | 9.77 | .40 | 6.06 | 4.40 | 2.20 | 1.56 | 8.86 | .98 | 3.60 |
| Fordhook | 1.07 | 5.42 | 4.00 | 3.88 | 1.11 | 3.09 | 1.50 | 5.00 | 1.52 | 3.94 | 1.56 | 2.70 |
| Average | 1.87 | 6.37 | 4.40 | 5.59 | .73 | 3.79 | 1.64 | 2.72 | 1.81 | 6.18 | .80 | 2.63 |

TABLE 2.—YIELDS OF LIMA BEANS GROWN UNDER IRRIGATION, WITH AND WITHOUT INOCULATION
(Weight of pods per plant in ounces)

| Variety | Inoculated | | | | | | Not inoculated | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. |
| Burpee Improved | .32 | 6.09 | 4.50 | 5.18 | .63 | 3.34 | .28 | 6.07 | 2.80 | 5.58 | .30 | 3.00 |
| Burpee's Bush | 1.00 | 6.27 | 4.10 | 4.52 | .87 | 3.37 | 1.10 | 6.64 | 4.00 | 4.32 | 1.03 | 3.41 |
| New Wonder | 1.80 | 4.28 | 5.90 | 4.52 | 1.11 | 3.32 | 1.10 | 4.92 | 5.70 | 4.44 | .84 | 3.40 |
| Dreer's | 5.30 | 9.20 | 3.70 | 8.65 | .75 | 5.52 | 5.80 | 8.83 | 5.50 | 9.77 | .40 | 6.06 |
| Fordhook | 1.10 | 7.37 | 2.40 | 4.41 | 1.65 | 3.38 | 1.07 | 5.42 | 4.00 | 3.88 | 1.11 | 3.09 |
| Average | 1.90 | 6.64 | 4.12 | 5.45 | 1.00 | 3.82 | 1.87 | 6.37 | 4.40 | 5.59 | .73 | 3.79 |

in 1920 and 1921, but that as an average for the five years every variety yielded better with irrigation than without. The average yield for the five varieties for the five years was 44 percent greater from the irrigated than from the non-irrigated plants.

### Non-Irrigated Plants Benefited by Inoculation

Yields of the irrigated beans grown with and without inoculation are given in Table 2. While in some instances the yields were greater from the inoculated plants, the differences were often slight, and in the case of three varieties the average yields for the five years were slightly less from the inoculated than from the non-inoculated plants. The five-year average for all varieties combined showed no material advantage from inoculation when the beans were grown under irrigation.

On the other hand, Table 3, giving the yields of inoculated and non-inoculated beans grown without irrigation, shows entirely different results from inoculation. Except in 1921 every variety yielded better nearly every year when inoculated than when not inoculated, and the five-year average for every variety was in favor of inoculation. The average yield for the five varieties for the five years was 19 percent greater from the inoculated than the non-inoculated plants.

Where irrigation is not possible, it would appear that inoculation may reasonably be expected to increase the yield.

### Nitrate of Soda With Irrigation Produced Highest Yields

The effect of nitrate was tested only in connection with the beans grown under irrigation. The plan was to make the conditions as favorable as possible for a strong vegetative growth, and to note the productiveness under such conditions, rather than to test the effect of nitrate alone. The yields of the irrigated beans, with and without nitrate, are given in Table 4.

It will be noted that while in certain instances the yields were lower from the nitrated than from the non-nitrated beans, the five-year average for every variety was greater where the nitrate was used than where it was not. The five-year average for the five varieties combined shows 7 percent increase in yield evidently due to the nitrate treatment. While this is not a very material increase in yield over the yield obtained from irrigation alone, it is the highest average yield from any treatment tested, and indicates that making the conditions especially favorable for strong vegetative growth is at least not detrimental to the yield of beans.

### Bone Meal Without Irrigation Increases Yields

Bone meal was used only with the plants grown without irrigation. This treatment was introduced in order to test the effect of

TABLE 3.—YIELDS OF LIMA BEANS GROWN WITHOUT IRRIGATION, WITH AND WITHOUT INOCULATION
(Weight of pods per plant in ounces)

| Variety | Inoculated | | | | | | Not inoculated | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. |
| Burpee Improved | .50 | 7.60 | 2.18 | 6.97 | .50 | 3.55 | .40 | 3.00 | 2.33 | 6.19 | .45 | 2.47 |
| Burpee's Bush | 1.03 | 2.80 | 1.39 | 5.37 | .70 | 2.25 | .60 | 1.40 | 2.08 | 5.26 | .40 | 1.95 |
| New Wonder | 1.80 | 2.50 | 1.64 | 6.75 | 1.00 | 2.74 | 1.30 | 2.00 | 1.58 | 6.66 | .63 | 2.43 |
| Dreer's | 4.07 | 3.30 | .81 | 9.46 | 1.04 | 3.73 | 4.40 | 2.20 | 1.56 | 8.86 | .98 | 3.60 |
| Fordhook | 1.80 | 7.70 | 1.18 | 4.87 | 1.59 | 3.43 | 1.50 | 5.00 | 1.52 | 3.94 | 1.56 | 2.70 |
| Average | 1.84 | 4.78 | 1.44 | 6.68 | .96 | 3.14 | 1.64 | 2.72 | 1.81 | 6.18 | .80 | 2.63 |

TABLE 4.—YIELDS OF LIMA BEANS GROWN UNDER IRRIGATION, WITH AND WITHOUT NITRATE
(Weight of pods per plant in ounces)

| Variety | With nitrate | | | | | | Without nitrate | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. |
| Burpee Improved | .43 | 5.59 | 3.90 | 5.96 | .82 | 3.36 | .28 | 6.07 | 2.80 | 5.58 | .30 | 3.00 |
| Burpee's Bush | 1.30 | 6.46 | 4.50 | 5.03 | .57 | 3.51 | 1.10 | 6.64 | 4.00 | 4.32 | 1.03 | 3.41 |
| New Wonder | 2.40 | 4.74 | 5.00 | 4.64 | 1.04 | 3.56 | 1.10 | 4.92 | 5.70 | 4.44 | .84 | 3.40 |
| Dreer's | 6.60 | 10.87 | 3.40 | 10.91 | 1.50 | 6.65 | 5.80 | 8.83 | 5.50 | 9.77 | .40 | 6.06 |
| Fordhook | 1.30 | 6.45 | 2.90 | 4.41 | 1.51 | 3.27 | 1.07 | 5.42 | 4.00 | 3.88 | 1.11 | 3.09 |
| Average | 2.30 | 6.82 | 3.94 | 6.19 | 1.08 | 4.06 | 1.87 | 6.37 | 4.40 | 5.59 | .73 | 3.79 |

TABLE 5.—YIELDS OF LIMA BEANS WITH AND WITHOUT BONE MEAL
(Weight of pods per plant in ounces)

| Variety | With bone meal | | | | | | Without bone meal | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. | 1919 | 1920 | 1921 | 1922 | 1923 | Aver. |
| Burpee Improved | .70 | 6.50 | 3.90 | 6.98 | .41 | 3.70 | .40 | 3.00 | 2.33 | 6.19 | .45 | 2.47 |
| Burpee's Bush | 1.20 | 1.60 | 1.44 | 5.84 | .97 | 2.21 | .60 | 1.40 | 2.08 | 5.26 | .40 | 1.95 |
| New Wonder | 1.80 | 1.30 | 1.66 | 7.28 | .97 | 2.60 | 1.30 | 2.00 | 1.58 | 6.66 | .63 | 2.43 |
| Dreer's | 4.20 | 3.30 | 1.63 | 9.14 | .83 | 3.82 | 4.40 | 2.20 | 1.56 | 8.86 | .98 | 3.60 |
| Fordhook | 1.50 | 5.20 | 1.71 | 4.51 | 1.76 | 2.93 | 1.50 | 5.00 | 1.52 | 3.94 | 1.56 | 2.70 |
| Average | 1.88 | 3.58 | 2.07 | 6.75 | .99 | 3.05 | 1.64 | 2.72 | 1.81 | 6.18 | .80 | 2.63 |

furnishing conditions presumably favorable to the development of the fruit and seed parts of the plant rather than the vegetative parts. The yields of beans grown with and without bone meal are given in Table 5.

This table shows that the average yield for each variety was greater where the bone meal was used. The five-year average for all varieties shows that the beans treated with bone meal yielded approximately 16 percent more than those grown without bone meal.

### Dreer's Bush Lima Most Promising Variety

While marked differences in yields of lima beans were secured under the different treatments, there were still greater differences between the yields of different varieties. By far the highest average yields were secured from Dreer's Bush Lima. This variety had the highest five-year average yield under every treatment; and if the average yields for all six treatments are combined for the five years, the Dreer's Bush Lima shows a 51 percent greater yield than any of the other varieties. This is the most promising variety, among those tested, for the production of green lima beans under market-garden conditions in the corn belt. It is of the potato lima type, but sells on the market on the same basis as the large, flat-seeded type.

## PREPARATION OF LIMA BEANS FOR MARKET

Lima beans should be picked as soon as the beans have attained full size and before they begin to turn white. The market demands that the beans be green. While the beans keep better in the pod than shelled, most markets demand them in the shelled form. Shelling is facilitated if the pods are allowed to wilt for a few hours before the shelling is commenced. Care should be taken to prevent the heating of the beans either before or after they are shelled. It is a good plan to spread the pods out on a cellar floor as soon as they are picked. They may be kept in such a place for two or three days pending shelling if necessary.

The beans are shelled by hand and placed in pint berry boxes. The boxes should be allowed to stand where the air will circulate about them for an hour or two after the shelled beans are put into them. They may then be placed in crates for hauling to market. The standard package for lima beans is a 24-pint case.

While most markets at present require that lima beans be shelled before they are offered for sale, it would undoubtedly be possible to develop a trade in lima beans in the pod in local markets where the producer sells directly to the consumer. The personal recommendation of the producer and the assurance that the beans keep better in the pod and are also more sanitary when so handled should go a long way toward popularizing this method of handling green limas. The

beans could also be sold cheaper in the pod, since the labor of shelling is a large item of expense in connection with their production and marketing.